ESO 611

# FARM MANAGEMENT CAPITAL INVESTMENT DECISIONS:

# METHODS OF ANALYSIS*

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# INTRODUCTION

Capital investment decisions are among the most important and difficult decisions that farmers must make. Their importance is demonstrated by the magnitude of investments being made for machinery, land, buildings and other assets that affect current and future operations of the farm business. A reasonable estimate for aggregate capital purchases that U.S. farmers will make in 1979 is $35 billion. Individually, farmers may be faced with expenditures ranging from $1000 to $1,000,000 or more. The major difficulty with these decisions arises from the fact that capital expenditures are current and lumpy, while the benefits accrue over the life of the assets. The future nature of the income-expense stream presents a real challenge to farm decision-makers. The soundness of their decisions, and hence their financial viability, is directly dependent upon their ability to reliably predict costs and returns for as many as five, ten, or even twenty years. Realistic estimates by themselves do not, however, result in sound investment decisions. These data must be analyzed.

A framework for evaluating individual and alternative investments that considers taxes, planning horizon, capital costs, inflation, risk, depreciation, financing, etc. must be used if the decisions are to be economically sound. In addition the method of analysis must be understood and useable by the farmers making the decisions. It behooves us as Farm Management Specialists to identify, develop, and teach that method to farmers so as to improve their decision-making capability.

There are numerous ways in which investment decisions are made, not all which can properly be referred to as analysis. These range from subjective evaluation to simple partial budgeting to the more complex quantitative methods. The finance literature is, for the most part, consistent when dealing with the identification and description of commonly used methods of analysis. There are, however, some unresolved issues that need the attention of financial theorists and pragmatic extension educators. The most critical of these being the inclusion or exclusion of financing terms in the investment decision.

## ALTERNATIVE MEASURES OF INVESTMENT WORTH

The literature abounds with detailed discussions of commonly used methods of analysis and the numerous variations of each. The following presentation is not an attempt to present each method in detail but simply a brief description of commonly used methods that will assist us as Extension Specialists in identifying that method we should further develop and teach our clientele to use.

### URGENCY

Common and often legitimate, this method requires little effort or there is little time to make a definitive analysis. Many of the "urgent" decisions are going to be of the "common sense" variety, such as replacing a vacuum pump in the milking system, and do not warrant formal economic analysis. However, the procrastinator utilizes this method even for major investment decisions. Guesses, hunches, intuition, and subject judgements rather than economic rationale are the basis for making decisions.

PAYBACK PERIOD

The payback period, one of the simplest and most frequently used methods of analysis, is the time it takes the firm to recover the initial investment from the earnings produced from the investment. The decision-maker arbitrarily sets some maximum acceptable payback period for different types of investments (land, buildings, equipment, etc.) and rejects investments when the expected payback exceeds this maximum. The common use of this techinque provides supportive evidence of the dampening effect that uncertainty and lengthy planning horizons have upon investment decisions. It also demonstrates that timing of cash flow is important although it doesn't explicitly account for differences in timing.

The formula is very simple and easy to understand and use:

$$P = \frac{I}{E}$$

where: P is the payback period in years
I is the investment required
E is the additional average annual after-tax net cash

The payback period, as a method of analysis, has some serious weaknesses, even though it may be useful to managers. It fails to consider differences in the timing of cash flows during the payback period, i.e., two investments with the same payback period but one has more cash coming in sooner. Conversely, it fails to consider cash flows occuring after payback is achieved, i.e., two investments with equal payback periods but one has income beyond the payback period and the other doesn't. These weaknesses seriously limit the usefulness of this method despite its ease of use and understandability. It can lead to wrong decisions.

RETURN ON INVESTMENT

In common use, this method expresses average annual net income (after depreciation) as a percentage of the original or average investment.

Once again the formula used in this calculation is simple and easy to understand:

$$R = \frac{E-D}{I}$$

where: R is the average annual rate of return
E is the additional average after-tax net cash
D is the depreciation
I is the investment required (initial or average)

This method is superior to the payback period because it considers earnings for the life of the investment rather than only up to the payback period. It too has weaknesses that limit its usefulness. The rate of return calculated is not directly comparable to the rate quoted on borrowed funds or with that obtained on equity capital invested in financial securities. Like the payback period, the return on investment methods fails to consider the timing of cash flows and can result in erroneous decisions, particularly with investments that have an increasing cash flow overtime.

DISCOUNTED CASH FLOWS

Two generally accepted methods for analyzing investments that explicitly consider the timing of cash flows and develop a cut-off criterion that is meaningful when compared to the cost of funds used for the investment are (1) the net present value (NPV) method and (2) the internal rate of return (IRR) method. Both utilize the same cash flow projections and require that a minimum acceptable rate of return be specified. With the NPV method, the cash flow is discounted by

this rate and the project is judged as acceptable if its NPV is equal to or greater than zero. With the IRR method, the discount rate that equates the NPV to zero is calculated and if greater than or equal to the minimum acceptable rate the project is judged to be a good investment. In most cases the methods will result in the same accept-reject decision.

The same general formula is used for both methods and is more complicated and difficult to use than either the payback or return on investment method:

$$NPV = -I + \frac{E_1}{1+i} + \frac{E_2}{(1+i)^2} + \ldots + \frac{E_n}{(1+i)^n} + \frac{S_n}{(1+i)^n}$$

where: NPV is the net present value of the investment
I is the initial investment of capital
$E_n$ is the annual after-tax net cash flow
i is the discount rate

When using the NPV method "i" is predetermined and the equation is solved for NPV. When using the IRR method NPV is set equal to "0" and the equation is solved for "i". The NPV method requires a single solution while the IRR method requires repeated solutions (trial and error) along with linear interpolation to find the solution. The NPV method is easier to use, is not plagued by multiple internal rates of return and is judged by most financial experts as being superior to the IRR method.

Neither method, however, will result in erroneous decisions as do the payback or rate of return methods. They will evaluate individual projects and rank alternative projects correctly. Each of the discounted cash flow methods permits the inclusion of opportunity cost of capital, risk, uncertainty, and inflation. In addition both

provide information on profitability and feasibility (cash flow requirements). An often overlooked characteristic of the NPV method that sets it apart from the other methods described is the fact that it produces a weighted value of the worth of the investment, i.e., two investments with the same payback and rates of return can have significantly different NPVs. The one with the higher NPV is the better investment.

It is, however, the NPV method where the experts disagree with regard to the inclusion or exclusion of financing arrangements in the projected cash flows. Bierman and Smidt, and most other writers, argue that financing is a separate decision to be made only after a "yes" investment decision is made. Consequently they exclude cash flows associated with financing from their NPV calculations. Barry, Hopkins, and Baker, on the other hand, strongly suggest that investment and financing decisions are integrally related and should be considered together as NPV is calculated. Lee takes a "middle of the road position". In principle he agrees with Bierman but when it comes to a practical application he uses Barry's method. Aplin and Casler are in the middle with a slightly different version. They imply that investment capital can be entered either in the Bierman (lump at beginning) or Barry (amortized) fashion but not both. They agree with Bierman and disagree with Barry by stating the inclusion of interest and finance charges in the cash flow is double counting.

Both approaches are intuitively appealing. It is possible that a project with a negative NPV using the Bierman method can be positive when the financing arrangements are included in the cash flow. Hence it is the financing that is profitable and not the investment itself.

This would lead one to believe that the investment should stand alone and be judged apart from the financing decision. On the other hand as one remembers that both methods are based on discounted cash flows it seems only right that capital outlay not be entered prematurely as is the case with Bierman. It seems more logical that capital outlay be entered as it is expected to occur in accord with the payment schedule.

Bierman is correct when he says that capital expense entered in the initial period and finance costs entered in subsequent periods is double counting. Barry is correct when he states that double counting does not occur when capital and finance charges are entered as per the amortization schedule.

The issue then rests on the Bierman contention that investment and financing are separable decisions. It appears that Barry argues a special case of Bierman's general solution by assuming only one finance arrangement is available. If three different finance arrangements were available Barry would solve each "investment-finance" package and select the best plan. Bierman on the other hand would have four solutions, assuming a positive NPV for the project analysis. These would be the project analysis and three finance analyses. Both solution procedures would end up the same place assuming Bierman's project analysis has a positive NPV. If it is negative it is quite possible that Barry would accept the project while Bierman would reject it.

Bierman contends, and correctly so, that "inclusion of the debt financing cash flows in the investment analysis with no limit on the amount of debt, by a suitable useage of debt we can make any conventional investment with a rate of return greater than the cost of debt have a positive present value". The key issue then settles down to the idea

of unlimited debt. Barry is not dealing with a situation where debt is unlimited. He is dealing with a specific debt and repayment structure and the question the farmer is asking is--"Will I be better off by making this investment and financing it by plan A or B or by not making the investment?"

## SUMMARY

The economic literature provides overwhelming evidence that NPV is the best method for analyzing potential investments. This author is convinced that Barry's approach of including debt financing in the after-tax cash flows is correct. It does not double count interest and enables the planner to develop capital budgets and discounted cash flows that are consistent with the generally accepted concept of cash flow. We as Extension Economists in Farm Management should do our utmost to develop materials and educational programs that will assist farmers in understanding and using this method of investment analysis.